Source Protection Strategy Update: Preparedness Workgroup

February 19, 2019

9:00-12:00

Rm: 208c 29 Hazen Dr. Concord, NH

Pierce Rigrod

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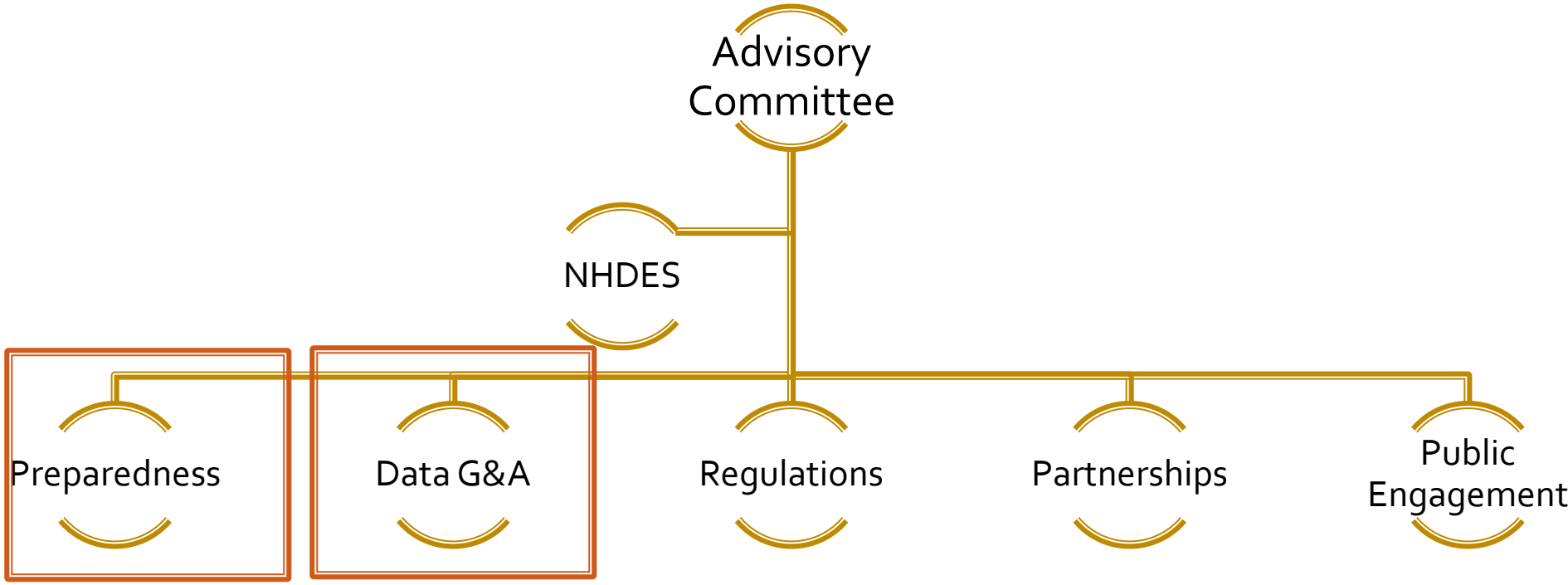
Purpose

- Promote and facilitate strategies that:
  - prevent the contamination and
  - preserve the availability

…of New Hampshire's present ***and*** future drinking water sources.

Strategy Update: Organization



Google – "Strategy Update Drinking Water NH" for online docs

Today's Agenda

- Review preliminary findings discussed in the Preparedness and Data Gathering and Analysis work groups.
- Work groups included subject matter experts
- Present some preliminary findings & obtain feedback, questions and direction

Preparedness Work Group

- 1. Finding: Mobile spills continue to occur near/into sources.
  - Goffstown - Uncanoonuc Reservoir(2018)
  - Manchester to PWW (2018)
  - Somersworth – Salmon Falls River (2018)

700 gal. spill on Mountain Road, Goffstown, NH Nov. 2018,

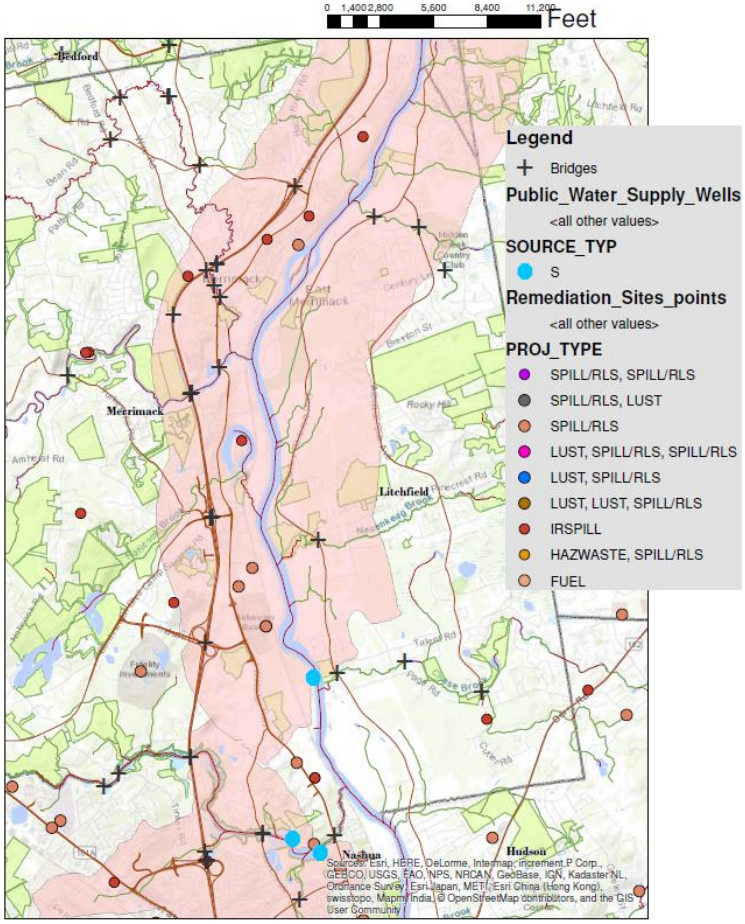
Historical Pattern of Spills (25 gal or greater)

- Nearly 100 spills on record in the NRPC region.
- 35 spills >= 25 gallons within the HAC.

Spills By Town

Town	Total Spills	Spills Within Sourcewater Protection Area	Spills Within HAC
Amherst	5	5	0
Hollis	1	1	0
Hudson	26	0	15
Litchfield	1	0	0
Merrimack	13	11	9
Milford	10	10	0
Nashua	40	9	11
Total	96	36	35

Spills & Releases Up-Grandient of Nashua's Intake



Preparedness: Storage of Hazardous Substances in HACs

- #2 Finding: Large volumes of Hazardous Substances are stored at Tier II facilities in Hydrologic Areas of Concern (HACs).
- Statewide 632 ASTs are within (HACs)
  - 281 "High risk" (ASTs) public health
    - 184 Petroleum
    - 97 non-petroleum (may not inspected)

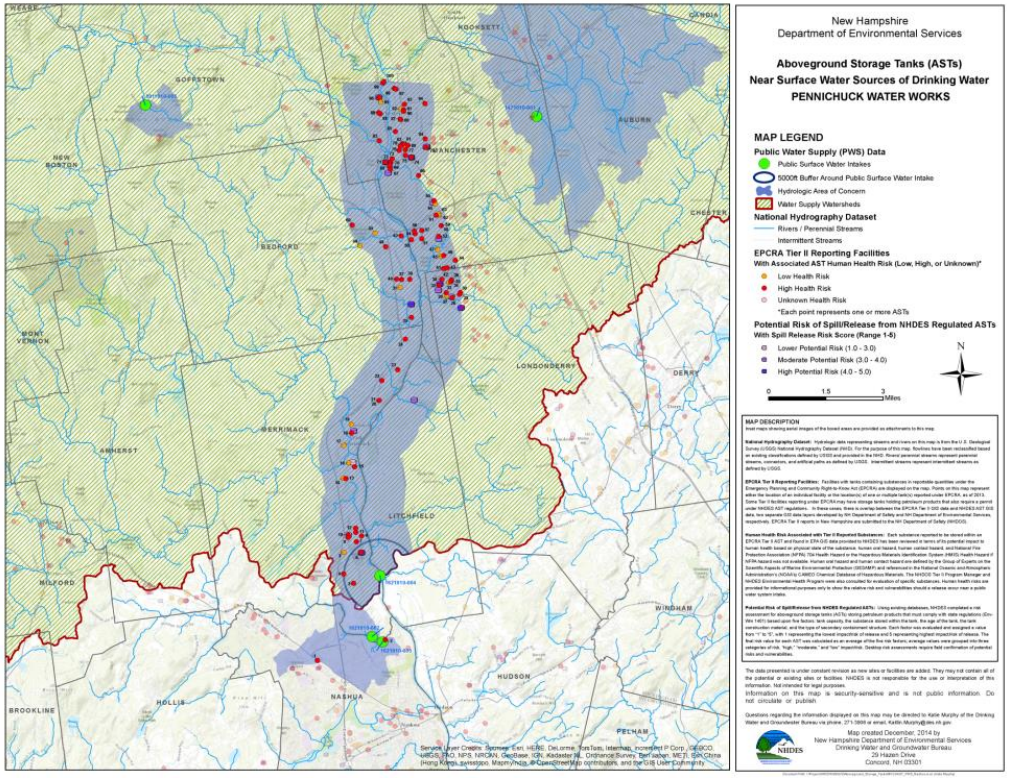


Table 1: U.S. EPCRA Tier II Reporting Facilities within the Hydrologic Area of Concern: Pennichuck Water Works

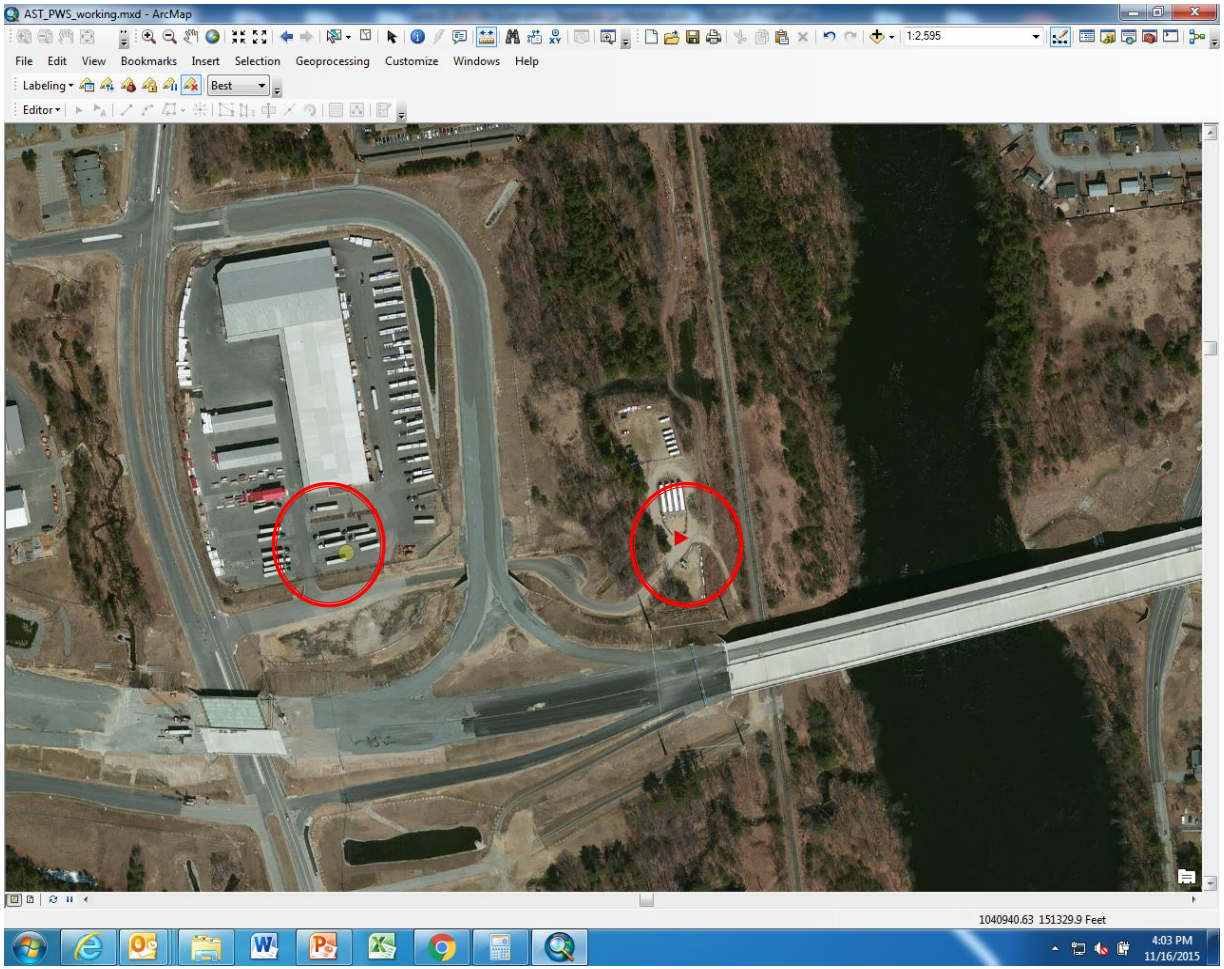
Facility Name	Street Address	Town and State	Material Stored	Quantity Stored
PSNH Nashua Area Work Center	370 Amherst Street	Nashua, NH	Petroleum electrical insulating oil	5752 gal
Pennichuck Water Works, Inc. Water Treatment Facility	200 Concord Street	Nashua, NH	Carbon dioxide/ Water treatment chemical/ Diesel/ Ferric chloride/ Sodium hydroxide/ Sodium hypochlorite solution	60000 lbs/ 79000 lbs / 13161 gal/ 97000 lbs/ 16810 gal/ 15819 gal
BAE Systems	130 & 144 Daniel Webster Highway	Merrimack, NH	Sodium chloride/ Lead/ Nitrogen, refrigerated liquid (cryogenic liquid)/ Diesel/ Fuel oil, no. 2/ Transformer oil/ Sulfuric acid	Not available
Boston Consolidated Tracon/FAA	25 Robert Milligan Parkway	Merrimack, NH	Diesel/ Diesel/ Sulfuric acid	3799 gal/ 31208 gal/ 33 gal
Kollsman	220 Daniel Webster Highway	Merrimack, NH	Nitrogen, refrigerated liquid (cryogenic liquid)	40652 gal
Anheuser-Busch, LLC	221 Daniel Webster Highway	Merrimack, NH	Carbon dioxide/ ADHESIVE (Bottle Label)/ ADHESIVE (Hot Melt)/ Batteries, lead & sulfuric acid/ Activated carbon/ Calcium sulfate, gypsum/ Sodium chloride/ Perlite/ PC Smart Foam/ Ferrous chloride/ Nitric acid/ Magnesium hydroxide/ PEX-GLIDE (Conveyor Lubricant)/ Sodium hypochlorite solution/ Propane/ Ammonia, anhydrous/ Nitrogen, refrigerated liquid (cryogenic liquid)/ Fuel oil, no. 2, no. 6 blend/ Propylene glycol/ Sodium hydroxide solution/ Sulfuric acid	Not available
PSNH Busch Substation (Merrimack 1)	221 Daniel Webster Highway	Merrimack, NH	Petroleum electrical insulating oil	5620 gal
PSNH GT Solar	243 Daniel Webster Highway	Merrimack, NH	Petroleum electrical insulating oil	1700 gal
PSNH Eagle Transmission Substation	223 Star Drive	Merrimack, NH	Lead/ Sulfuric acid	4104 lbs/ 44 gal
PSNH Thornton Distribution Substation	239 Daniel Webster Highway (Rt 3)	Merrimack, NH	Petroleum electrical insulating oil	7419 gal
Student Transportation of America	14 Star Drive	Merrimack, NH	Sulfuric acid	93 gal
Colt Refining, Inc	12A Star Drive	Merrimack, NH	Copper/ Lead/ Silver/ Solder/ Potassium cyanide/ Potassium cyanide/ Calcium hydroxide/ Sulfuric acid	191927 lbs/ 11600 lbs/ 14250 lbs/ 11076 lbs/ 550 lbs/ 2486 lbs/ 40375 lbs/ 78 gal
U.S. Cellular - Congress Park MTSO	19 Columbia Circle	Merrimack, NH	Lead/ Diesel/ Sulfuric acid	41472 lbs/ 21240 2882 gal/ 489 gal
EnergyNorth Propane	25 & 25B Columbia Circle	Merrimack, NH	Propane	2617 gal
JCI Jones Chemicals, Inc	40 Railroad Avenue	Merrimack, NH	Chlorine/ Sulfur dioxide/ Sodium bisulfite solution/ Sodium hypochlorite solution/ Ammonia, anhydrous/ Sodium hydroxide solution	Not available
Fairpoint MERRIMACK CO	417 Daniew Webster Highway	Merrimack, NH	Batteries, lead-acid	50118 lbs
EnergyNorth Propane	458 Daniel Webster Highway	Merrimack, NH	Propane	2617 gal
PSNH Reeds Ferry Substation (Merrimack 3)	14 Twin Bridges Road	Merrimack, NH	Petroleum electrical insulating oil	10020 gal
Eastern Propane Gas, Inc.	Merrimack Commons Bulk 1, 515 Daniel Webster Highway	Merrimack, NH	Propane	6281 gal
PSNH Merrimack Distribution Substation (Merrimack 2)	1503 Depot Street	Merrimack, NH	Petroleum electrical insulating oil	1394 gal
Eastern Propane Gas, Inc.	Depot Street Bulk, Depot Street	Merrimack, NH	Propane	2792 gal
Rye Fuel Company dba Rochette's Oil Service	658 Daniel Webster Highway	Merrimack, NH	Fuel oil	Not available
Saint-Gobain Performance Plastics Corporation	701 Daniel Webster Highway	Merrimack, NH	Transformer oil/ PTFE Dispersions/ Lead, in batteries/ Sand and salt mixture/ Batteries, wet, acid-filled (2)/ Oil, miscellaneous/ Fuel oil, no. 2	2467 gal/ Not available
PSNH North Merrimack Transmission Substation	750 Daniel Webster Highway	Merrimack, NH	Lead/ Sulfuric acid	4320 lbs/ 47 gal

Tier II reporting & Inspection

- Tier II tanks are not inspected and it isn't clear if substances can potentially be discharged via stormwater.
- Volumes and substances at Tier II facilities may change over short periods of time.
- West Virginia requires facilities to provide information regarding hazardous substances and their quantities stored on site directly to downstream water suppliers.

Large Storage of Hazardous Substances May not be Accurately Geo-located

- Finding #3: Tank locations within reported Tier II data do not show actual locations.



- Substances reported may change or be incomplete.
- Reporting under Tier II is incomplete per USEPA opinion
- Tier II tank containment and controls may not be verified via inspection.
- The data sharing protocol among state agencies is not uniform.

Spills, Drain Networks & New US EPA MS4 Permit

- Many unknowns about illicit discharges
- Outfalls discharging to a drinking water area as "high priority" under MS4 permits. (Section 3.2.1 NH Public Drinking Water Requirements ,USEPA MS4 Permit)
- Finding #4: Stormwater discharges that include untreated substances (illicit discharges) present a real threat to drinking water

"The threat of an accidental spill contaminating the Pennichuck Brook system is very real. In December of 1994, an accidental oil spill at the Greased Lightning facility leaked into a floor drain, **which was connected to a storm drain**, and was discharged to the Holt Pond." *Pennichuck Brook Watershed Restoration Plan (2012)*

Transportation Networks & Spills

- Little knowledge of possible hazard areas for accidents including tight curves, intersections, and narrow bridges
- Finding #5: A review of spill history may give a better understanding of areas prone to mobile spills and potential mitigating actions.

700 gal. spill on Mountain Road, Goffstown, NH Nov. 2018,

Mobile threats present a variable point of potential contaminant entry into the source water, making them more difficult to monitor. (USEPA, p.12, 2016)

Emergency Plans Are Required but Not Training or Exercising Plans

- CWS emergency plans are not required to be exercised
- Emergency response training is not required for water operators.
- Plans are not likely shared with local responders.

- Exercises are expensive but requiring them could be based on vulnerability or frequency of past events.
- Require training for PWS operators
- Require copies of PWS emergency plans are sent to local responders

Emergency Communications

- First responders may not be aware of down-stream sources and may not be notified.
- Communications between local first responders and nearby PWS's is not governed by a standard protocol.
- Interstate communications of spills between states by NRC may ensure notification of reported events to out-of-state PWSs.
- Supports, including distributing GIS maps and data to local first responders and emergency response training may improve communications.

Salmon Falls Full Scale Exercise, June 2017

Finding #6 CWS and local emergency response training and mutual awareness will improve communications and capacity to work together during an event.

Real Time Organic Detection Systems

- ODSs provide redundancy if human communications fail.
- Real-time monitoring for VOCs is employed on larger, interstate river-based sources.
- It can be expensive.
- Sensors can indicate false positives.
- GC/MS, GC/FID can screen for thousands of VOCs.
- Requires several hours a day (person-time)
- Less expense systems may be more appropriate
- Sensitivity thresholds are important to fine tune false positives.

Finding # 7 Real-time source water monitoring allows rapid screening for a wide array of VOCs and may serve to quickly inform PWSs of appropriate actions.

Organics Detection System (ODS)

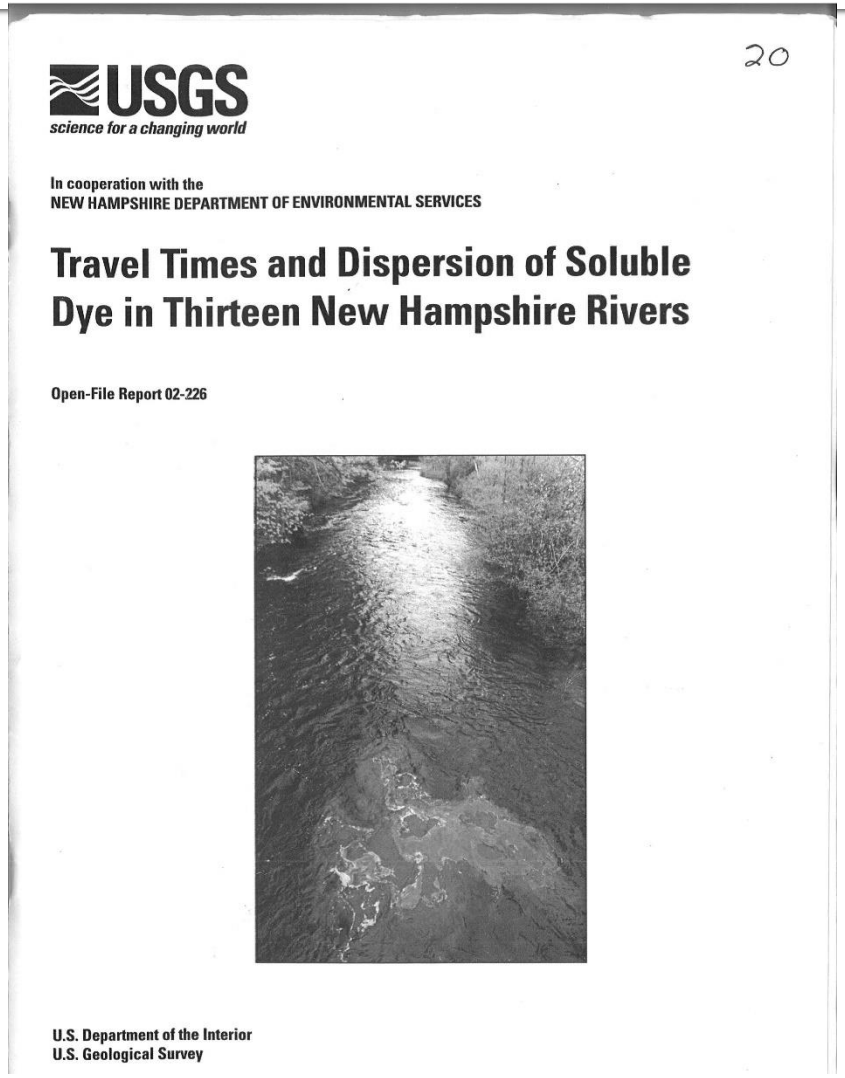
New ODS Analyte List

- Methylene Chloride
- 1,1 Dichloroethylene
- 1,1 Dichloroethane
- Chloroform
- 1,1,1 Trichloroethane
- Carbon Tetrachloride
- Benzene
- Trichloroethylene
- 1,2 Dichloropropane
- Dichlorobromomethane
- Toluene
- Tetrachloroethylene
- Dibromochloromethane
- Ethylbenzene
- Chlorobenzene
- Styrene (co-elutes with o,p xylenes)
- Bromoform
- 1,3 Dichlorobenzene
- 1,4 Dichlorobenzene
- 1,2 Dichlorobenzene
- Acrylonitrile
- 1,2 Dichloroethane
- trans-1,2 Dichloroethylene
- cis-1,3 Dichloropropene
- trans-1,3 Dichloropopene
- Hexachloro-1,3-butadiene
- 1,1, 2,2 Tetrachloroethane
- 1,1,2 Trichloroethane
- Trichlorofluoromethane
- Napthalene

Source: http://www.orsanco.org/programs/organics-detection-system-ods

The Organics Detection System is a cooperative effort involving water utilities and other major Ohio River water users to monitor volatile organic compounds (VOCs) in the river. The program is designed to detect low level concentrations of volatile organic compounds at water intakes located on the Ohio River and certain tributaries for purposes of monitoring water quality conditions for the protection of public water supplies. Seventeen gas chromatographs (GCs) located on the Ohio, Allegheny, Monongahela, Kanawha and Elk rivers are operated daily to assure that unreported releases or spills of organic compounds do not compromise drinking water intakes

Time of travel and Estimating Contaminant Concentrations



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USGS
science for a changing world

In cooperation with the
NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES

Travel Times and Dispersion of Soluble Dye in Thirteen New Hampshire Rivers

Open-File Report 02-226

U.S. Department of the Interior
U.S. Geological Survey

- USGS dye study done for 13 rivers in NH used as sources;
- Models a six-hour time of travel to intake;
- Estimates leading edge, peak concentration and trailing edge of a contaminant
- Provides a quick way to estimate time contaminant reaches the intake and concentration

USGS' 2000 time of travel study

- It's not clear that the tool is used by PWS operators
- Finding# 8: Training and online availability may increase the likelihood it will be used during an emergency.

Preliminary Findings: Preparedness (1 of 2)

- Spills continue to occur near/into sources
- Large volumes of Hazardous Substances are present at Petroleum/Tier II facilities within a number of HACs, some go uninspected.
- Tank locations holding hazardous substances (Tier II reported) may not not show actual storage locations.
- Stormwater discharges that include untreated substances (illicit discharges) present a real threat to drinking water.
- A review of spill history may give a better understanding of areas prone to mobile spills and potential mitigating actions.
- CWS and local emergency response training and mutual awareness will improve communications and capacity to work together during an event.

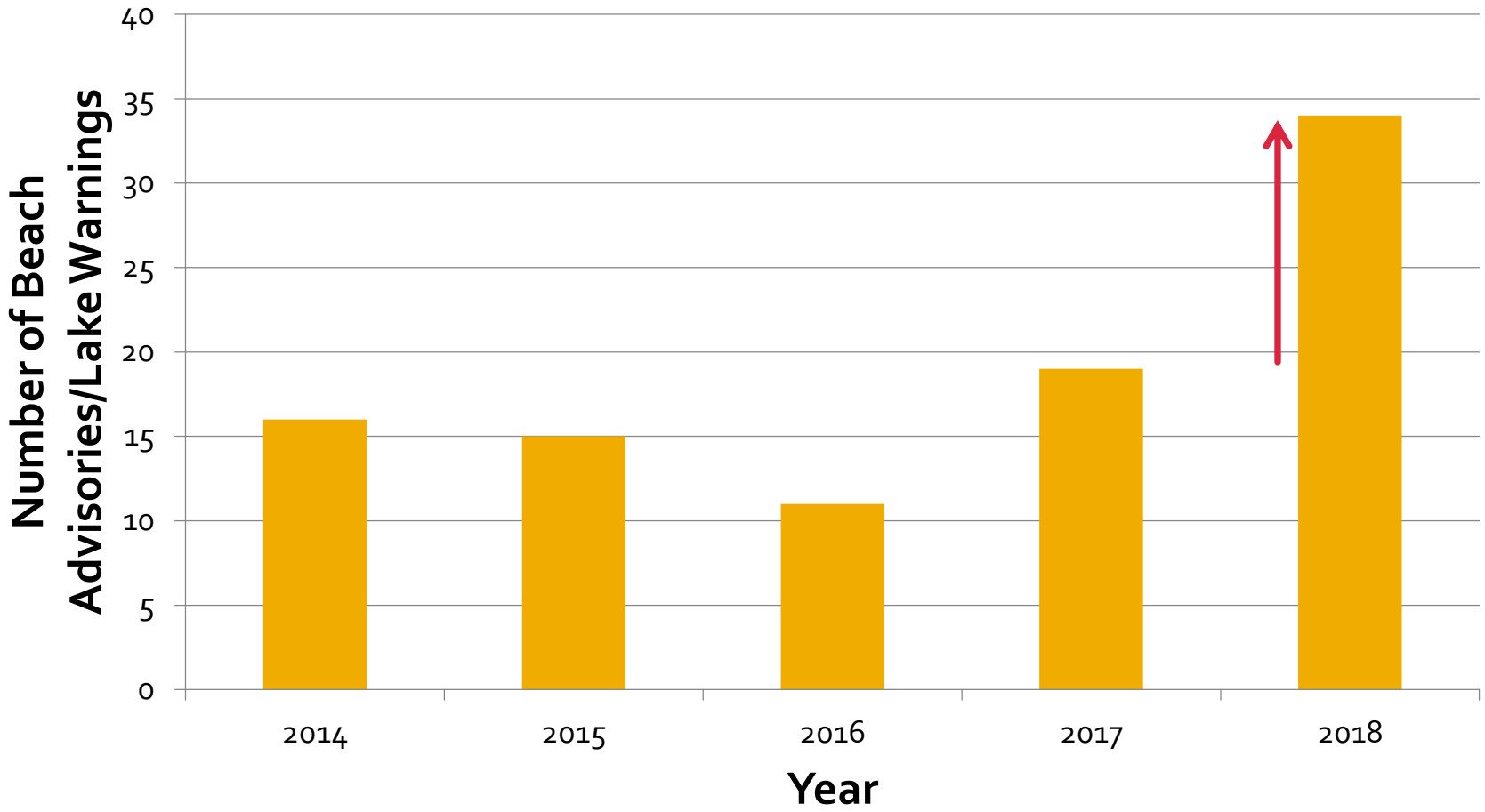
Findings (2 of 2)

- Real-time source water monitoring allows rapid screening for a wide array of VOCs and may serve to quickly inform PWSs of appropriate actions.
- Time of Travel study allows a rapid approach to calculate concentration/time of arrival in "real time" but may require regular training and a faster online "app."

Report Out Data Gathering/Analysis

- Cyanobacteria/Harmful Cyanobacteria Blooms
  - Prevent
    - Prevent conditions conducive to toxin development
    - Prevent exposure to toxins through monitoring
  - Response
    - Appropriate actions based on data and effective PWS response to HCBs

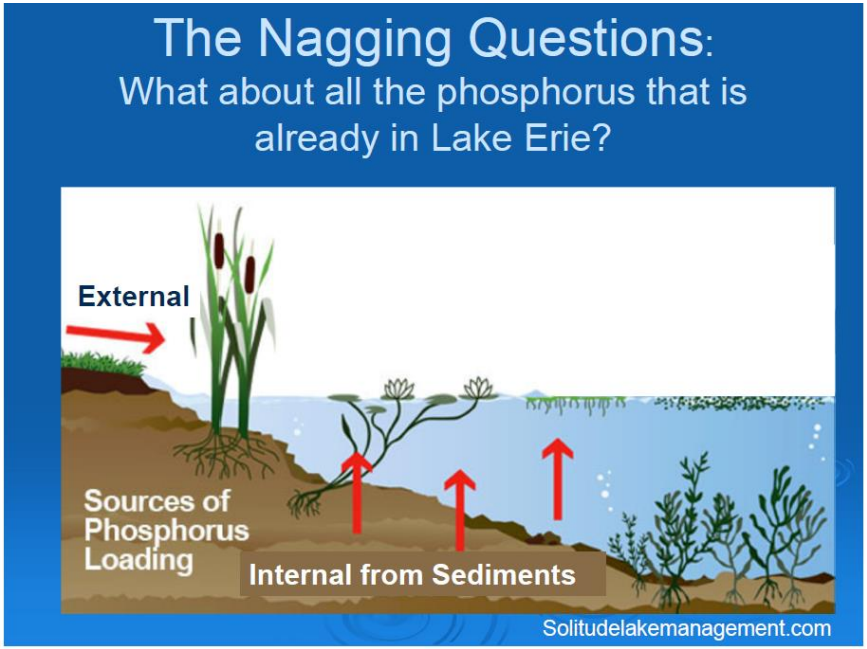
Cyanobacteria Blooms Causing Beach Closures in NH



A. McQuaid, NHDES

Nutrients & Cyanobacterial Blooms?

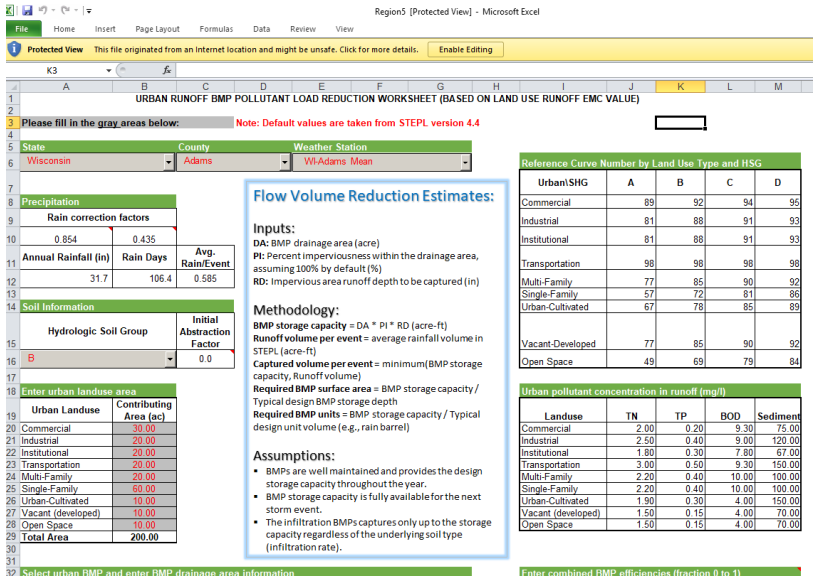
- Certain environmental conditions, such as elevated levels of nutrients from human activities (e.g., nitrogen and phosphorus), warmer temperatures, still water, and plentiful sunlight can promote the growth of cyanobacteria to higher densities, forming cyanobacterial blooms. (US EPA, website 2019)
- Important to measure N, P that is bioavailable and the ratio of N:P.
- Important to measure/model **in-lake loading** as well as external nutrient inputs to surface water.



"Even if external loading is reduced by 40% or more, will we still continue to have large HCBs for years or decades because of recycling of P from Lake sediments?" (Bridgeman, Thomas, Univ of Toledo, Lake Erie HABs: Nutrient Cause and Effect

Planning, Nutrients and Cyanobacteria

- A loading analysis and subsequent nutrient tracking of a particular water body would allow for a determination of the internal loading of phosphorus (P), a known contributor to cyanobacteria population growth.



Region5 [Protected View] - Microsoft Excel

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URBAN RUNOFF BMP POLLUTANT LOAD REDUCTION WORKSHEET (BASED ON LAND USE RUNOFF EMC VALUE)

Please fill in the gray areas below: Note: Default values are taken from STEPL version 4.4

State	County	Weather Station
Wisconsin	Adams	WI-Adams Mean

Precipitation

Rain correction factors		
0.854	0.435	
Annual Rainfall (in)	Rain Days	Avg. Rain/Event
31.7	106.4	0.585

Soil Information

Hydrologic Soil Group	Initial Abstraction Factor
B	0.0

Enter urban landuse area

Urban Landuse	Contributing Area (ac)
Commercial	30.00
Industrial	20.00
Institutional	20.00
Transportation	20.00
Multi-Family	20.00
Single-Family	60.00
Urban-Cultivated	10.00
Vacant (developed)	10.00
Open Space	10.00
Total Area	200.00

Select urban BMP and enter BMP drainage area information

Flow Volume Reduction Estimates:

Inputs:

DA: BMP drainage area (acre)

PI: Percent imperviousness within the drainage area, assuming 100% by default (%)

RD: Impervious area runoff depth to be captured (in)

Methodology:

BMP storage capacity = DA * PI * RD (acre-ft)

Runoff volume per event = average rainfall volume in STEPL (acre-ft)

Captured volume per event = minimum(BMP storage capacity, Runoff volume)

Required BMP surface area = BMP storage capacity / Typical design BMP storage depth

Required BMP units = BMP storage capacity / Typical design unit volume (e.g., rain barrel)

Assumptions:

- BMPs are well maintained and provides the design storage capacity throughout the year.
- BMP storage capacity is fully available for the next storm event.
- The infiltration BMPs captures only up to the storage capacity regardless of the underlying soil type (infiltration rate).

Reference Curve Number by Land Use Type and HSG

Urban\SHG	A	B	C	D
Commercial	89	92	94	95
Industrial	81	88	91	93
Institutional	81	88	91	93
Transportation	98	98	98	98
Multi-Family	77	85	90	92
Single-Family	57	72	81	86
Urban-Cultivated	67	78	85	89
Vacant-Developed	77	85	90	92
Open Space	49	69	79	84

Urban pollutant concentration in runoff (mg/l)

Landuse	TN	TP	BOD	Sediment
Commercial	2.00	0.20	9.30	75.00
Industrial	2.50	0.40	9.00	120.00
Institutional	1.80	0.30	7.80	67.00
Transportation	3.00	0.50	9.30	150.00
Multi-Family	2.20	0.40	10.00	100.00
Single-Family	2.20	0.40	10.00	100.00
Urban-Cultivated	1.90	0.30	4.00	150.00
Vacant (developed)	1.50	0.15	4.00	70.00
Open Space	1.50	0.15	4.00	70.00

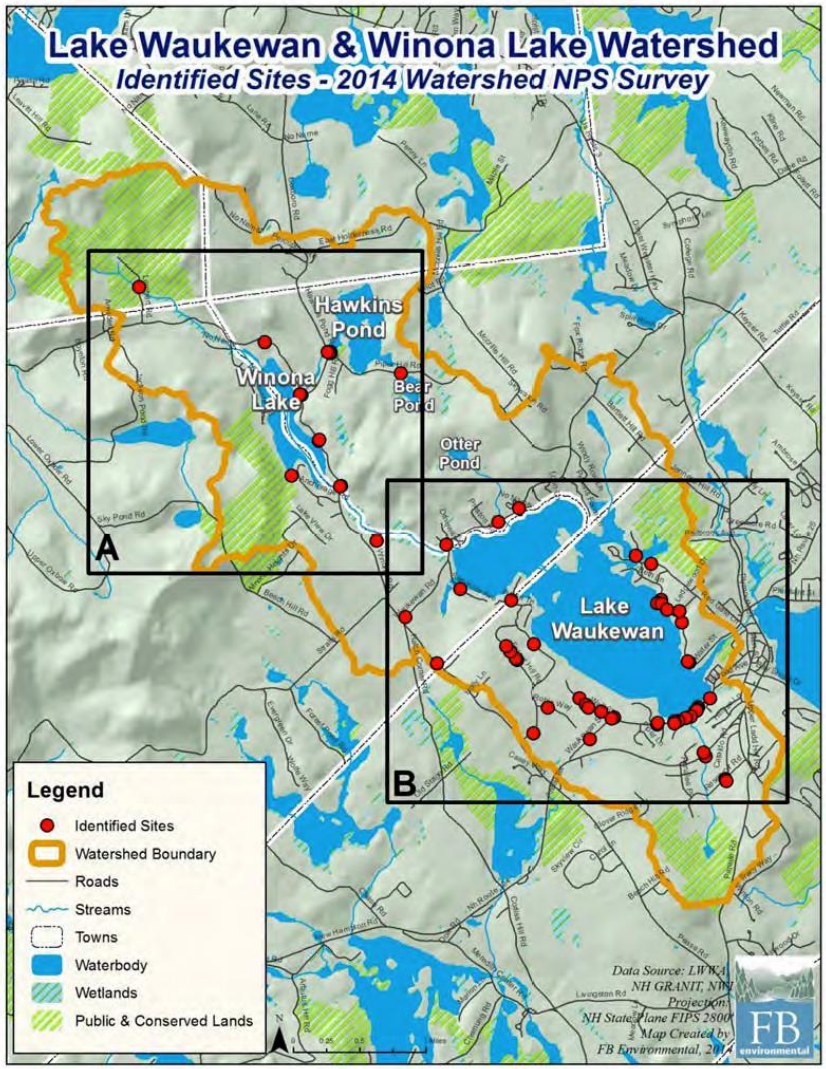
Enter combined BMP efficiencies (fraction 0 to 1)

The EPA Region 5 Model was used to calculate the reduction in pollutant load in response to the implementation of BMPs in the Lake Waukewan and Winona watershed

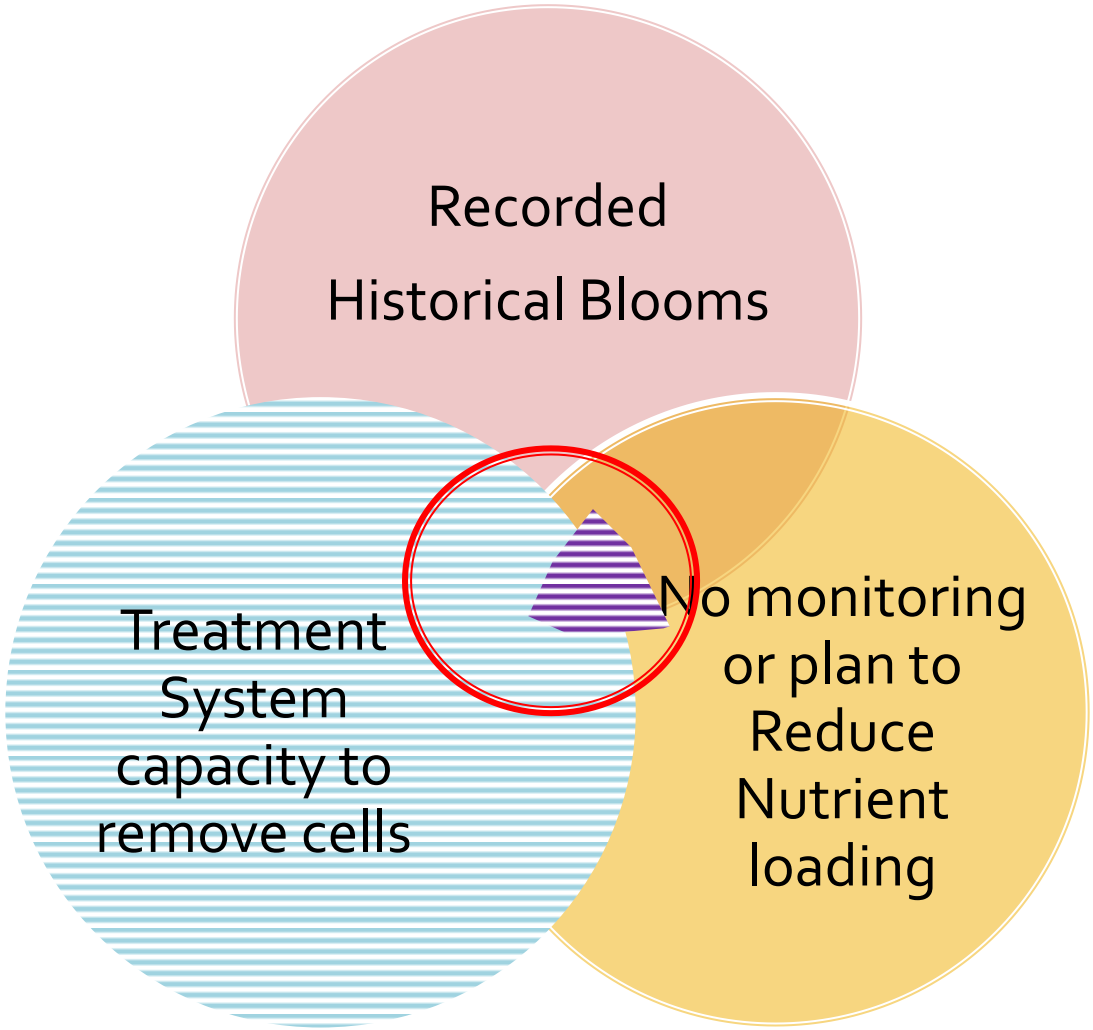
Finding #1: Closer monitoring and modeling nutrients should be a priority in sources with HCBs.

Nutrients: Reduction through Watershed Planning/Restoration

- "Ideally, if all 65 problem sites identified in the 2014 watershed survey were treated with Best Management Practices (BMPs), and all new development contained proper phosphorus controls, these annual TP loadings would be significantly reduced."



Vulnerability to HCBs: Prioritize resources based upon …



- ✓ History of toxic blooms
- ✓ Treatment not able to remove cells
- ✓ No monitoring , higher nutrient conditions/impaired for P, N
- ✓ Toxic conditions near intakes

Vulnerability & Prioritizing Cyanobacteria (HCBs)

Watershed Plans	Cell Filtration Capability	Historic Blooms On Record
30 PWS Surface Sources w/o Watershed Plan Vs. 22 Sources having Watershed plans	44 PWS Surface Sources that can filter Cells Vs. 8 PWS Surface Sources w/o treatment likely to filter cells	11 PWS Surface Sources with cyanobacteria blooms Vs. 41 PWS Surface Sources without recorded blooms

Highest Priority?

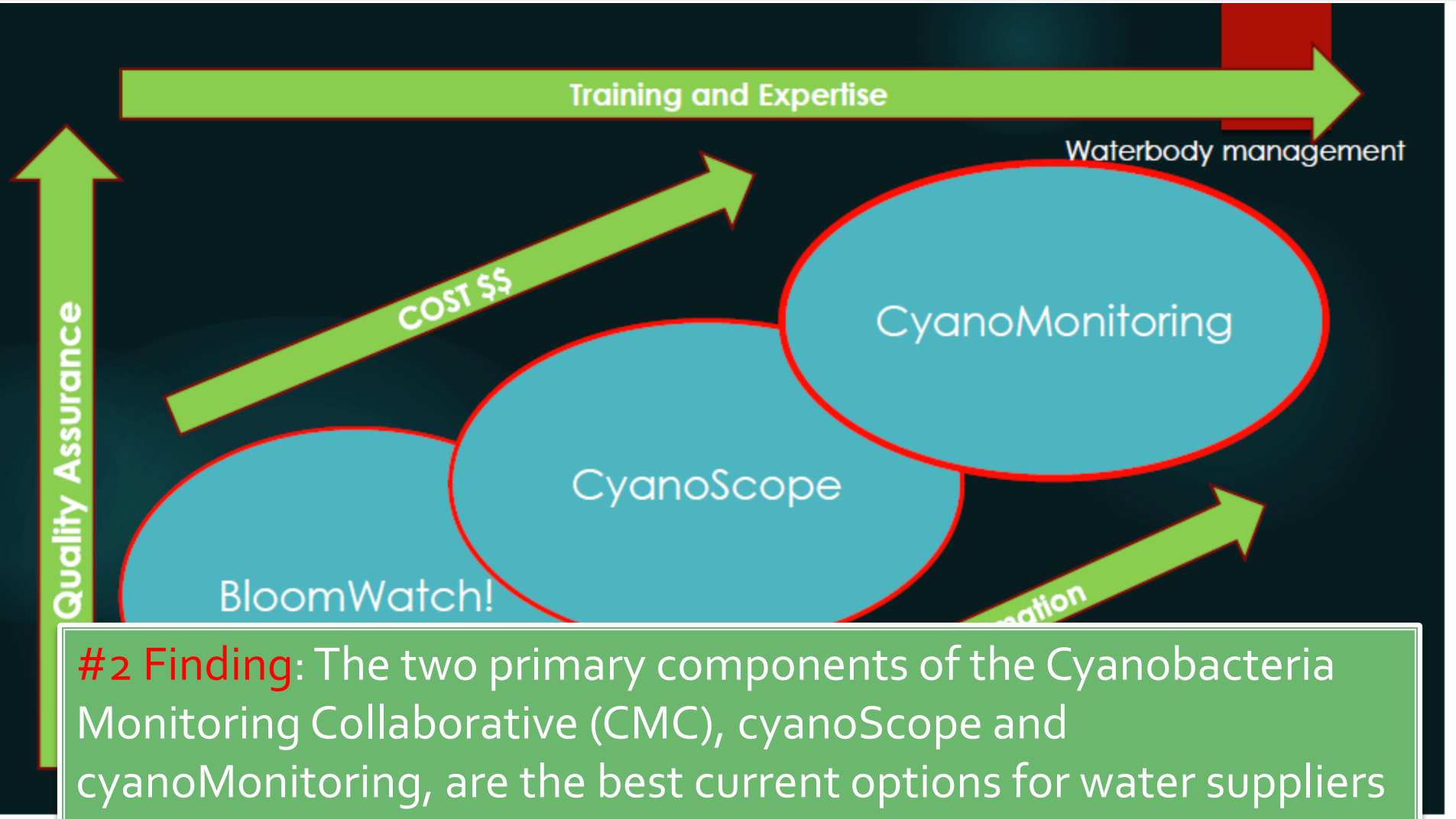
- ✓ No watershed plans or monitoring program
- ✓ No capacity to filter cells
- ✓ Historic Blooms in Sources

Vulnerability to HCBs could be based on nutrient loading/watershed planning, capacity to remove cells via treatment, water quality metrics may help target state resources.

NH Surface Water Sources with Confirmed Cyanobacteria Blooms (2006-2018) – blue = cyano monitoring

Drinking Water Supply / Water Body	Public Water System Name	Town	Genera of Concern	Date of ID of Most Recent Bloom
1. Lake Waukewan	Meredith Water Department	Meredith, NH	*Dolichospermum*	9/1/2018
2. Arlington Mill Pond	Salem Water Department	Salem, NH	*Dolichospermum, Aphanocapsa*	8/16/2018
3. Massabesic Lake	Manchester Water Works	Manchester, NH / Auburn, NH	*Dolichospermum*	6/6/2018
4. Clark Pond (Lake Massabesic watershed)	Manchester Water Works	Auburn, NH	*Oscillatoria*	8/9/2017
5. Canaan Street Lake	Canaan Water Department	Canaan, NH	*Dolichospermum*	6/8/2017
6. Tower Hill Pond (Lake Massabesic watershed)	Manchester Water Works	Auburn, NH / Candia, NH	*Dolichospermum*	9/15/2016
7. Harris Pond	Pennichuck Water Works	Nashua, NH	*Dolichospermum*	9/7/2016
8. Mascoma River	Lebanon Water Department	Lebanon, NH	*Microcystis, Woronichina Coelosphaerium*	9/9/2014
9. Swains Lake	Swains Lake Village Water	Barrington, NH	*Dolichospermum, Microcystis*	6/13/2013
10. Rochester Reservoir	Rochester Water Department	Rochester, NH	*Dolichospermum*	6/16/2006
11. Lake Sunapee	Sunapee Water Works	Sunapee, NH	*Gloeotrichia*	2012

US EPA Region 1 "CMC" Training



#2 Finding: The two primary components of the Cyanobacteria Monitoring Collaborative (CMC), cyanoScope and cyanoMonitoring, are the best current options for water suppliers to engage in monitoring.

US EPA Region 1 & UNH:

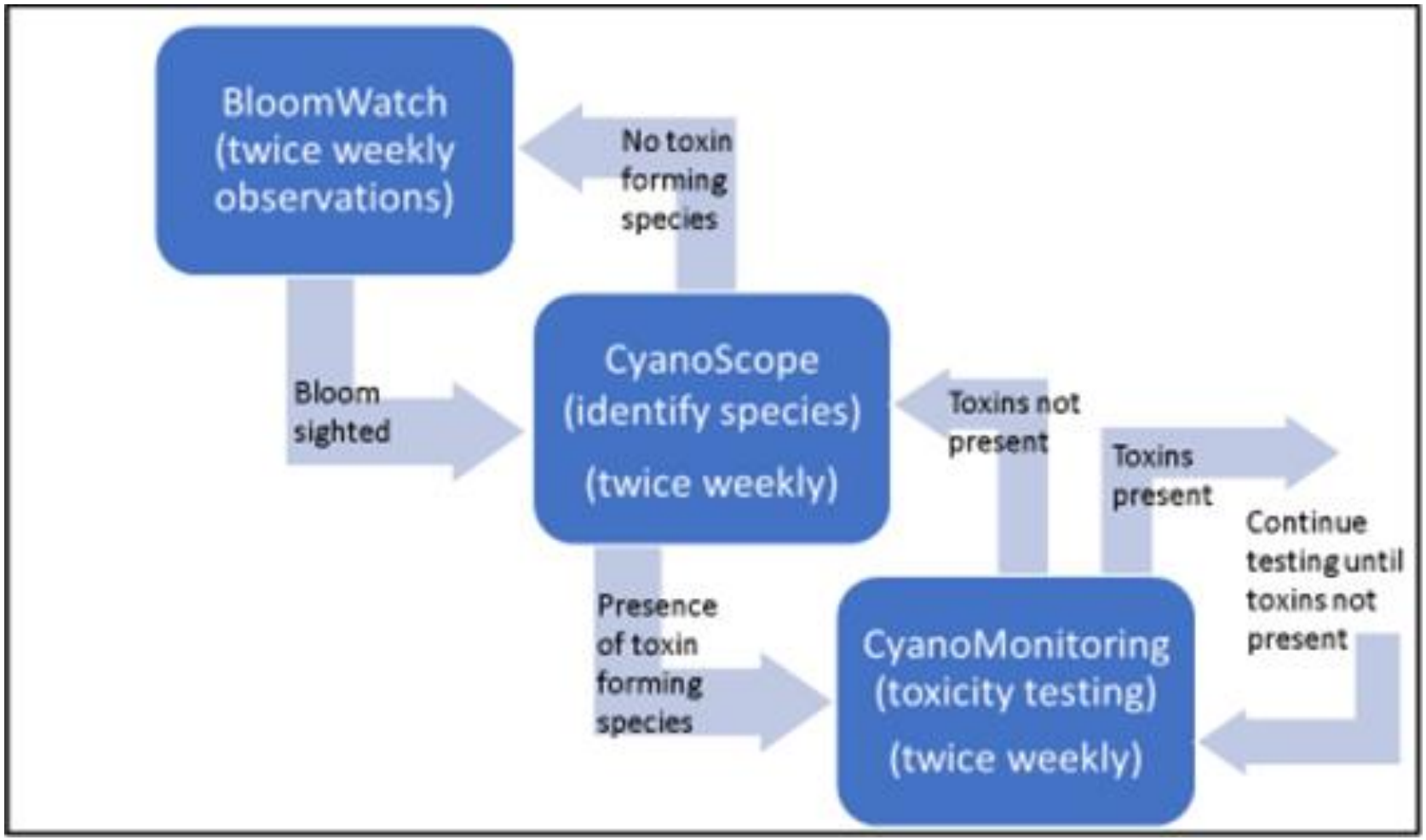
#3 Finding: Training in microscope operation and cyanobacteria identification procedures would be highly effective in allowing water systems the ability to participate in cyanoScope monitoring, identified during this meeting as a critical component to any monitoring program.

CMC: Flourometry

Handheld 2-Channel Flourometer

- Chlorophyll
  - .25 - 2,500 ppb
- Phycocyanin
  - 10 - 100,000 ppb
- Other 2-chnl handhelds available
- $1,500 - $2,500
- Stnds approx. $200 each
- Rhodamine solid state standards (2 year shelf)

Keene's Monitoring Program (modified CMC)



Keene SSPP, 2018

CyanoCasting: New approach for predicting Harmful Cyanobacteria Blooms (UNH)

- Uses CMC data as inputs (fluorometry for pigment, cyanoScope to identify genus)
- cyanoCasting (bi-weekly sampling)
  - Sample phytoplanton (community composition, dominance)
  - Pigment analysis (fluorometry)
- **Key Qs:** Do Bloom Forming Compounds dominate the water column? Increasing logarithmically? Toxin producing genus?

NHDES: Source Protection & Cyano

- Supporting the development of watershed management plans and monitoring to calculate and reduce nutrient loading
- Continuing to assist with purchase of monitoring equipment & surveillance
- Working with UNH/EPA to design a certificate training program for Water Operators on cyano
- Supporting and participate in research and work with PWSs and 3rd party entities to expand data collection (monitoring)
- Preparedness (protocol) – ensure protocol is distributed and investigate "real time" monitoring options

Support Training

- UNH to develop a potential "Cyanobacteria Certificate" for public water system operators, lake associations, volunteer monitors.
- **#4 Finding: Working group felt a UNH certificate/training program was worthwhile to pursue.**

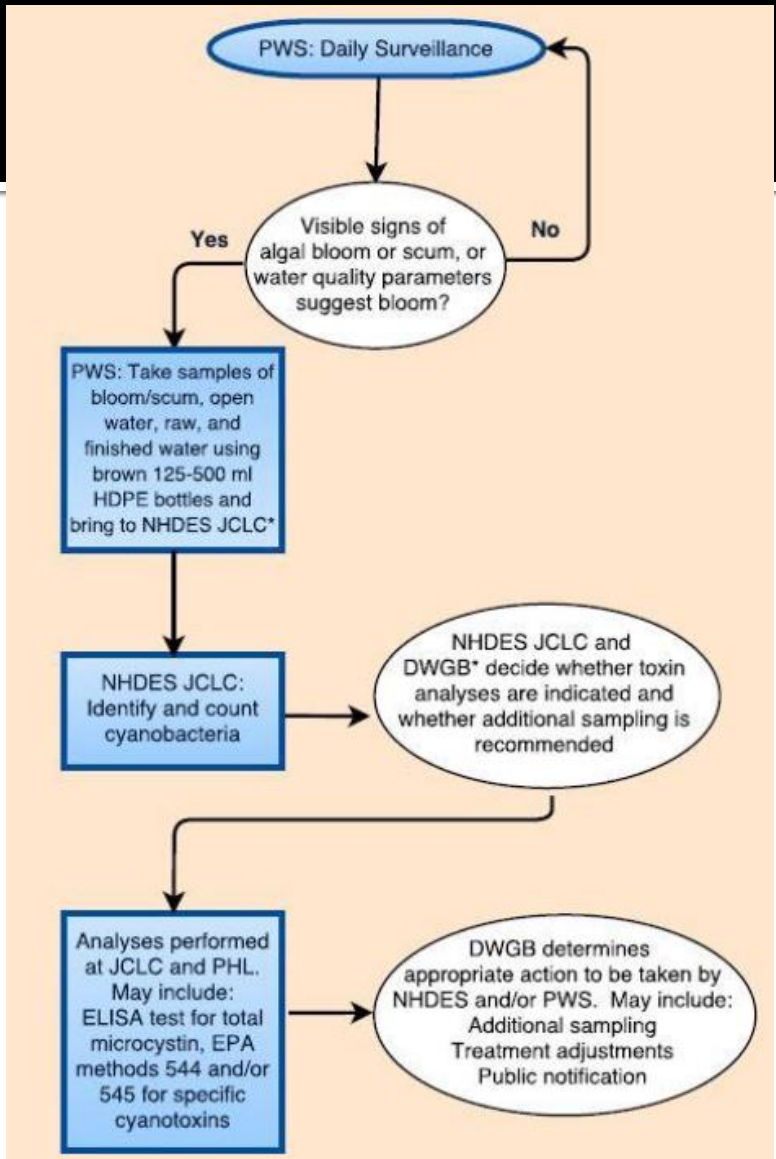
Possible Professional Development Training Elements

- ✓ Regulatory Overview
- ✓ Monitoring
- ✓ Cyanobacterial Ecology
- ✓ Sample Collection
- ✓ Identification
- ✓ Semi-quantitative Method for Composition and Dominance
- ✓ Sample Handling & Storage
- ✓ Fluorometric Analysis
- ✓ Use of the Screening Protocol

- Management
  - In-lake
  - In-plant

Support Response

- NHDES CyanoHAB Response Protocol for PWS – April 2017
  - What data is needed to properly assess/respond?
    - Cell count thresholds?
    - Toxin concentration



Finding #5: Emergency Protocol could reflect results of cyanoCasting analysis.

Consider Vulnerability?:

- Target work with PWSs based on criteria such as history and frequency of HCBs, proximity to intake, ability of PWSs to filter cells, lack of cyano monitoring, lack of watershed planning and known nutrient impairments or known nutrient loading issues.

Preliminary Findings: Data Gathering & Analysis Workgroup

- **Finding #1**: Closer monitoring and modeling nutrients should be a priority in sources with HCBs.

- **Finding #2**: The two primary components of the Cyanobacteria Monitoring Collaborative (CMC), cyanoScope and cyanoMonitoring, are the best current options for water suppliers to engage in monitoring.

Findings: (continued)

- **Finding #3** : Training in microscope operation and cyanobacteria identification procedures would be highly effective in allowing water systems the ability to participate in cyanoScope monitoring, identified during this meeting as a critical component to any monitoring program.
- **Finding #4 :** Working group felt a UNH certificate/training program was worthwhile to pursue.
- **Finding #5**: Emergency Protocol could reflect results of cyanoCasting analysis.

Strategy Update: Next Meetings